

Title	A DESIGN OF LOW CARBON DEVELOPMENT ACTION TOWARDS 2050 IN CAMBODIA(Abstract_要旨)
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論文題目	A DESIGN OF LOW CARBON DEVELOPMENT ACTION TOWARDS 2050 IN CAMBODIA (カンボジア国における 2050 年に向けた低炭素社会構築に関する研究)		
<p>(論文内容の要旨)</p> <p>Chapter 1 gives the overall background of the research and observes strengths and weaknesses of the current low carbon study and the implementation plan so that we can identify and propose a study on a low carbon development action in Cambodia as well as figure out objectives and scope, and research framework accordingly. In response to the proposed objectives, the analyses in Chapters 3-5 were made accordingly.</p> <p>Chapter 2 focuses on the overview of Cambodian situation related to the existing climate change mitigation strategies, the policies and the current status of low carbon development. This chapter indicates how and to what extent Cambodia is implementing the climate change mitigation related policies, strategies and activities and investigates the sectors of the economy which is considered as the potential impacts of GHG emissions and reduction potentials.</p> <p>Chapter 3 gives the overview of the quantitative tool used to quantify socioeconomic indicators and to estimate CO2 emissions and reduction potentials of the energy sector. This chapter describes energy demands and CO2 emissions as well as CO2 emissions reduction potential under low carbon measures. In this chapter, socioeconomic assumptions are also discussed; such as economic growth, transportation demand, and energy demand to illustrate how the assumptions go in line with some other countries' experiences in some Asian countries as well as illustrating the result of CO2 emissions and the reduction potentials by sectors and by categories of low carbon measures. The result indicated that CO2 emissions are projected to increase to around 23,277ktCO2/year and 91,327ktCO2/year, around 6 times and 22 times in 2030BaU and 2050BaU, respectively, compared to CO2 emission in 2010 which is around 4,221ktCO2/year. Under low carbon measures, CO2 emissions are expected to reduce by around 12,826ktCO2/year and 52,153ktCO2/year in 2030CM and 2050CM, respectively. Around 68% and 77% of total CO2 emissions reduction can be achieved by improving energy efficiency in 2030CM and 2050CM, respectively. Around 14% and 6% in 2030CM and 2050CM, respectively, can be achieved by adopting a modal shift, while the energy saving behavior and the conservation is expected to reduce CO2 emissions by around 12% and 9% in 2030CM and 2050CM, respectively.</p> <p>Chapter 4 gives the overview of a quantitative tool used to estimate GHG emissions and reduction potentials from the AFOLU sector based on the assumed socioeconomic indicators and on ongoing policies in the AFOLU sector. This chapter indicates the estimation of GHG emissions reduction potentials through taking several constraints such as mitigation measures and costs. In this chapter, the result of GHG emissions is discussed by comparing to some available information in the country such the Initial National Communication (INC), the Second National Communication (SNC) and the United States Environmental Protection Agency (U.S.EPA).</p> <p>The result yields that GHG emissions are projected to change from a net carbon sink of approximately 940ktCO2eq./year and 8,764ktCO2eq./year in 2010 and 2030BaU,</p>			

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<p>respectively, to a net emitter of around 13,982ktCO₂eq./year in 2050BaU. Under low carbon measures, total GHG emissions of approximately 24,461ktCO₂eq./year and 29,435ktCO₂eq./year in 2030CM and 2050CM, respectively, are expected to reduce. In the agricultural sector, around 64% and 70% of total GHG emissions are expected to reduce in 2030CM and 2050CM, respectively, and they are applied with the cost of less than 10USD/tCO₂, while in the Land Use, Land Use Change and Forestry (LULUCF) sector, the most plausible mitigation measures are applied with the cost of less than 50USD/tCO₂ and around 36% and 30% of total GHG emissions are expected to reduce in 2030CM and 2050CM, respectively.</p> <p>Chapter 5 summarizes the results of GHG emissions and reduction potentials of energy and AFOLU sectors and illustrates the change of per capita GHG emissions based on socioeconomic development and land use change. This chapter describes quantitative GHG emissions reduction potential based on the proposed eight low carbon development strategies towards 2050 in Cambodia and identifies appropriate low carbon actions, accordingly. Furthermore, this chapter illustrates a proposal for low carbon research network for Cambodia aiming to facilitate, enhance, and expands communication, cooperation, and participation from different stakeholders as well as bridging the gap between researchers and decision-makers.</p> <p>The results illustrated that total GHG emissions in Cambodia in energy and AFOLU sectors are projected to increase from around 3,281ktCO₂eq./year in 2010 to 14,514ktCO₂eq./year (around 4 times) and 105,307ktCO₂eq./year (around 32 times) in 2030BaU and 2050BaU, respectively. Under low carbon measures, GHG emissions of around 37,287ktCO₂eq./year and 81,588ktCO₂eq./year are expected to reduce in 2030CM and 2050CM, respectively. GHG emissions per capita are projected to increase from 0.24tCO₂eq./year in 2010 to 0.79tCO₂eq./year and 4.79tCO₂eq./year in 2030BaU and 2050BaU, respectively; however, they are expected to decrease to a negative value of around -1.24tCO₂eq./year in 2030CM and to 1.08tCO₂eq./year in 2050CM. In order to reach the GHG emissions reduction goal, this study proposed eight low carbon development strategies including green energy, green technologies and investment, green building, green transportation, low carbon infrastructure, sustainable forest management, green agriculture management and sustainable livestock management. Besides, several activities for each strategy are proposed.</p> <p>Cambodia is expected to become the net carbon sink, offsetting around 22,774ktCO₂eq./year in 2030CM, while around 77% of total GHG emissions are expected to reduce in 2050CM, respectively. The strategy on green agriculture management and sustainable forest management are expected to attribute to the largest share of total GHG emissions reduction (around 38% and 24%) in 2030CM, respectively, followed by green transportation (around 13%). However, green transportation and green agriculture management attribute to the biggest share of GHG emissions reduction of around 31% and 22% in 2050CM, respectively, followed by green energy (around 21%).</p> <p>In the last chapter, Chapter 6 concludes the above findings and proposes a recommendation for the Government and other stakeholders to improve data collection,</p>			

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<p>management and accessibility as well as making a suggestion of more studies on climate change mitigation and low carbon development in Cambodia to provide good insights for the Government to design the climate change mitigation policies and the low carbon development plan, accordingly.</p>			

(論文審査の結果の要旨)

本論文は、これまで日本及びアジア各地域を対象に開発されてきた低炭素計画策定手法を、現在、後発開発途上国であり今後の成長が著しいと期待されているカンボジャ国のエネルギー部門、農業・土地利用部門に適用し、種々の改良を加えることによって、その実用性を向上及び検証するとともに、同国の長期開発目標としての低炭素社会像を提唱したものであり、得られた主な成果は次のとおりである。

1. 後発開発途上国における温室効果ガス排出量については、これまでの農業・森林・土地利用部門からのみならず、急速な社会・経済成長とエネルギーシステムの近代化に伴った排出量増加が見込まれている。これらのほとんどの国では、長期的エネルギー計画・環境計画を策定しておらず、科学的な健全性を持ち長期的視野を持った低炭素社会シナリオの策定とそれに基づく行動計画を策定・実施する手法の確立が喫緊の課題となっている。この観点から、本論文では、これまでの「低炭素社会シナリオ」手法を基礎としながらも、特に後発開発途上国に必要な社会・経済・環境計画との共便益性を可能な限り発揮し、かつ、こうした地域に共通な問題である入手可能情報の僅少性と不明性に対しても頑健性を保つように手法の改良を行った。

2. 提案手法を、代表的な後発開発途上国であるカンボジャ国のエネルギー部門および農業・森林・土地利用部門に適用し、家庭・業務・工業・交通・農業・土地利用の各部門に適用し、温室効果ガス排出構造に関する詳細な同定及び排出量推計とその削減策の設計を行った。その結果、現行の開発計画を続行する場合、2010年時点の排出量である年 3.28 MtCO₂eq は、2050年で 105.31 MtCO₂eq となるが、本論文で提案する対策を行うことによって 2050年で 23.72 MtCO₂eq に抑制可能であることを示した。これは、一人当たり排出量で 1.1 tCO₂eq に相当する。さらに本論文では、抑制の具体的方策として 8つの対策群をデザインし、それが温室効果ガス排出抑制のみならず、関連する他の社会経済効果も期待できることを論じた。

以上のように、本論文は、後発開発途上国における低炭素社会計画策定を念頭に、対象地域の社会・経済的な特徴を踏ま

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え，情報不明性に対する頑健性と社会的受容性に富んだ計画の策定手法を提案・検証したものであり，学術的・社会的重要性も高い研究である．また，本研究の成果は，低炭素社会構築を目指すアジア他地域の低炭素社会実現にも大きく貢献するものであり，学術上，實際上寄与するところが少ない．よって，本論文は博士（工学）の学位論文として価値あるものと認める．また，平成 27 年 7 月 21 日，論文内容とそれに関連した事項について試問を行って，申請者が博士後期課程学位取得基準を満たしていることを確認し，合格と認めた．